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Public Management and Educational Performance: The Impact of Managerial Networking

Policies are implemented in complex networks of organizations and target populations. Effective action often requires managers to deal with an array of actors to procure resources, build support, coproduce results, and overcome obstacles to implementation. Few large-n studies have examined the crucial role that networks and network management can play in the execution of public policy. This study begins to fill this gap by analyzing performance over a five-year period in more than 500 U.S. school districts using a nonlinear, interactive, contingent model of management previously developed by the authors. The core idea is that management matters in policy implementation, but its impact is often nonlinear. One way that public managers can make a difference is by leveraging resources and buffering constraints in the program context. This investigation finds empirical support for key elements of the network-management portion of the model. Implications for public management are sketched.

Public policies are developed and implemented in complex networks. Analysts have documented this phenomenon in a number of countries and have sketched myriad reasons for its ubiquity (Bogason and Toonen 1998; Bressers, O'Toole, and Richardson 1995; Gage and Mandell 1990; Hufen and Ringeling 1990; Jordan and Schubert 1992; Klijn 1996; Marin and Mayntz 1991; Marsh and Rhodes 1992; Milward and Provan 2000; O'Toole 1998; Peterson and O'Toole 2001; Scharpf 1993). In the United States at the national level, even formal policy frequently calls for networked arrangements during execution (see Hall and O'Toole 2000). Similar trends exist at the subnational level (see Agranoff and McGuire 2000). Even in ostensibly hierarchical settings, interdependence requires that public managers deal regularly with clusters of other units to implement programs, procure resources, and gain support among stakeholders.

Students of policy implementation have devoted considerable attention to the multiactor, networked aspects of implementation (Stoker 1990; Kickert, Klijn, and Koppenjan 1997; O'Toole 2000). Ever since Pressman

and Wildavsky's classic study (1984) of economic development gone awry in Oakland, California, the challenge of the "complexity of joint action" has been prominent among serious analysts of implementation. The management dimensions of this issue, however, have been less thoroughly investigated. Many analysts recognize the importance of public managers' mobilizing implementation action in networks (Friend, Power, and Yewlett 1974;

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Mandell 1984; O'Toole 1983), but showing the real *impact* of network management is more difficult, as is determining how managers operating in networks can improve implementation.

Some key questions, therefore, demand attention: What difference does network-focused public management make for implementation? Do the ways that managers deal with complex surroundings make a difference in how programs work? How can managers make use of their complicated and interdependent settings to enhance performance? These key issues are at the center of this article.

Here we explore how public managers operate in networks, whether they make a difference in program outcomes, and—if so—how and why this might be the case. Our test case is a key policy area that has not received much recent attention in public management: public education (for earlier work, see Gross, Mason, and McEachern 1958; Zeigler, Kehoe, and Reisman 1985). Our approach is to investigate how managers operating in networks contribute to the educational performance of their students. The empirical setting selected for study is several hundred school districts in Texas, an especially large and diverse U.S. state.

Broadly, we are interested in the nitty-gritty ways that managing in networks may be different from managing solely in and through a hierarchy that is focused on program operations. Ultimately, exploring this subject can help us learn which kinds of managerial efforts may be practically useful in the complex settings that are a part of public administration.

Public Management and Networks

Public managers often operate in networked settings, where program success necessitates some collaboration and perhaps coordination with parties over whom they exercise little formal control. By *network*, we mean a pattern of two or more units, in which not all major components are encompassed within a single hierarchical array (O'Toole 1997). Actors in networks are often located in bureaucracies that are, in turn, connected with other organizations outside the lines of formal authority. Many of these complex arrangements are required or strongly encouraged by policy makers through interagency ties, intergovernmental links, or mandates for public-private partnership. Many others have emerged through negotiated, self-organizing initiatives of participants (Hjern and Porter 1981; Ostrom 1990). Managers may see ways to leverage their capacity for action by joining with other units in common pursuit of implementation success. Or they may conclude that others possess the financial resources or political strength to make a program more successful or more well protected.

Networks vary greatly in size, complexity, structure, and composition. They range from a simple tie between an agency and its contractor to a bewilderingly complex lattice of dozens of interlinked service providers, financing units, case-management bureaus, and support organizations—as can be found, for instance, in community mental health settings in American cities (Provan and Milward 1995). Network nodes may include public, for-profit, and nonprofit organizations or parts of organizations. These more complicated institutional arrangements require greater managerial attention and skill because those administering programs must link their own operations with others, tap resources in the broader network, limit potentially hostile forces, and encourage productive and collaborative partnerships. These and other network-management tasks call for actions beyond the POSDCORB injunctions of old.

What do public managers in networks do, and how can they make a difference? Are some managers more successful than others in such complex institutional settings? What are the managerial implications for improving implementation performance? This study focuses on a key choice made by managers: how much time and energy to work in the network, and in which directions? Managers may take a number of network-related actions, but the choice of when and where to network seems to be especially important.

Managing in Networks for U.S. Public Education

U.S. public education policies are implemented by locally managed school districts—usually separate, special-purpose governments without formal interdependence with other implementation units. The special-district design itself was developed precisely to buffer educational efforts from the potentially confounding actions of other governmental actors (Tyack 1974).

Nonetheless, the technical and political demands placed on school district superintendents—the chief administrators of the districts—encourage them to develop, solidify, and use ties with other important actors in their environments. The most important of these include their own school board (the elected body responsible for overall local policy), the relevant state-level educational department (a source of funding that varies in importance from state to state, as well as the locus of many regulations), state-level legislators (who frame general education policy), local business leaders (who play crucial roles in supporting the locally enacted taxing decisions that drive much of school district revenue), and other superintendents (professional colleagues and sources of experience and innovation in the turbulent world of public education).

In contemporary U.S. public education, where funding is critical and many supposedly separate policy problems

intrude in highly visible ways in the educational process, schools have become battlegrounds for numerous policy disputes (Chubb and Moe 1990; Meier and Stewart 1991). Education reforms are frequently debated and adopted in settings where the school district is only one voice among many. Accordingly, superintendents have reason to devote managerial energy and effort to understanding and leveraging their networked environment.

Superintendents manage their districts—a headquarters office along with sets of schools, which in turn are managed by school principals (as the term is used)—within this broader constellation of other actors, who may be important sources of funds, staff, ideas, guidance, other resources, and turbulence. The extent and kind of network to build, maintain, and use is a matter that is largely under the control of the superintendent.

Network development, then, is an opportunity available to superintendents who recognize their interdependence and try to manage it actively. The next section sketches a way to investigate whether superintendents' directing managerial time and effort toward networking can improve implementation performance, and—more interestingly—how networking might help managers improve their implementation success.

A Strategy for Exploring Network Management

While extensive and growing attention has been directed to the importance of networks in public management and policy implementation, important gaps remain. Some analysts use the term “network” as a general metaphor to designate complex environments. Others describe network settings with considerable care, but do not offer compelling theoretical explanations for what works and why. Still others craft vivid, instructive cases that assist our understanding of what managers do when they operate in networks and why that might be important. Even the best studies, however, have limits. They typically do not demonstrate conclusively the connection between network management, on the one hand, and implementation performance, on the other. They are most frequently designed as case studies or, at most, a comparison of a very small number of cases. Many factors could be influencing performance in any given case, and sorting them out and checking for the distinct influence of network management is often not possible.

Large-n studies are clearly needed that focus on network management in a way that permits controlling for other sources of program influence. In the following pages, we present a measure of network management that fits the educational program context explored in the empirical analysis, and we present evidence of its validity. Control-

ling for a range of other influences, we then test whether and how network management affects school districts' performance. Then, we explore whether higher-performing organizations do things differently than those that are less impressive. We examine patterns in how networkers deal with the opportunities and constraints in their complex settings by asking, do those who are more involved in the network find different ways getting of things done than do other managers?

To explore these questions, we use a theoretical model developed to understand public management's impact on program performance. The model is autoregressive and nonlinear. Of special use is the model's explicit distinction between management directed at networking in the environment of a core organization and other kinds of managerial efforts.

A Theory of Network Management

O'Toole and Meier (1999) provide a general model of managing programs and organizations of the following form:

$$O_t = \beta_1(H+M_1)O_{t-1} + \beta_2(X_t/H)(M_3/M_4) + \varepsilon_t [1],$$

where O is some measure of outcome; H is a measure of hierarchy normalized to range from 0 to 1; M denotes management, which can be divided into three parts— M_1 , management's contribution to organizational stability through additions to hierarchy and structure, M_3 , management's efforts to exploit the environment, and M_4 , management's effort to buffer environmental shocks; X is a vector of environmental forces; ε is an error term; the other subscripts denote time periods; and, β_1 and β_2 are estimable parameters.

The O'Toole–Meier model of management is autoregressive, nonlinear, and contingent. The autoregressive component is captured by the lagged dependent variable, thus requiring time-series data for estimation purposes. The nonlinear elements of the model are represented by various interaction effects, some designated as reciprocal functions. The model is contingent simply because hierarchy can be considered one end of a continuum with more fluid networks on the opposite pole. As the hierarchy variable moves toward zero, the model estimates how management affects programs in network-like settings.

O'Toole and Meier (1999) concede that no data set capable of operationalizing their full model exists, and perhaps it is unlikely to exist in the future. Some theoretical gains can be made, they suggest, by testing parts of the model and adjusting those parts in response to empirical results. Our simplification of the model is twofold. We will not deal with variations in hierarchy. Although school districts vary in structure, this variation is relatively small

compared to the variation that characterizes public programs in general. If we assume that structure can be treated as a constant (or relatively so), the model reduces to [2]:

$$O_t = \beta_1 (M_1) O_{t-1} + \beta_2 (X_t) (M_3/M_4) + \varepsilon_t \quad [2]$$

In the model's second term (that relating the organization to its environment), the ratio (M_3/M_4) is an elaboration of a general approach to managing the environment, which O'Toole and Meier term M_2 in its undifferentiated form. The internal management of operations, M_1 , is not the prime focus of this study of network-management activity, so this aspect of the full model is also excised from the simplified form we use for testing. By focusing exclusively on general environmental management, the specific model of management considered in this article is [3]:

$$O_t = \beta_1 O_{t-1} + \beta_2 (X_t M_2) + \varepsilon_t \quad [3]$$

M_2 is of particular interest for our present purposes because it represents managerial effort in and on the networked environment.

Methods

Units of Analysis

Our data on network management styles and performance come from a set of Texas school districts. District superintendents were sent a mail questionnaire on management styles, goals, and time allocations (return rate 55 percent with 507 usable responses).¹ We pooled five years (1995–99) of data on performance and control variables to produce a total of 2,535 cases for analysis. All nonsurvey data were from the Texas Education Agency.

School districts in the United States generally and all districts in the study are "independent" local governments with their own taxing powers.² While each district determines its own curriculum, policy, and personnel, all are subject to both state and federal regulations and receive funds from both sources. The amount of state funding and state control varies from state to state. Texas pays for about 50 percent of education costs, but its oversight focuses on accountability (time in class, testing, attendance, number of courses, etc.). These interdependencies with other governmental and nongovernmental units create the school district's network. Successful policy implementation requires school districts to work with parents, local elites, and other governments to acquire sufficient resources and to solve educational problems.

Although school districts are the most common public organizations in the United States, they have some distinct characteristics. School districts are highly professionalized, with elaborate certification processes for various occupations. The organizations themselves tend to be decentralized with a great deal of street-level (classroom) discre-

tion. If the findings here can be generalized, they would be applicable to similar types of organizations.

Measuring a Network Management Style

If managing in a network has a behavioral as well as a structural dimension, then one should be able to measure networking differences—the behavioral dimension—even across program settings that are ostensibly similar in structure, including those with core units that are hierarchies. The behavioral manifestation of a network management style is characterized by greater interaction with environmental actors who are not direct line subordinates or superiors. In the present case of school superintendents, we selected five sets of actors from the organization's environment—school board members, local business leaders, other school superintendents, state legislators, and the Texas Education Agency. We asked the superintendents how often they interacted with each actor, on a six-point scale ranging from daily to never. Superintendents with a network management style should interact more frequently with all five actors than should a superintendent with a traditional hierarchical management style.³ A composite network management style scale was created using factor analysis. All five items loaded positively on the first factor, producing an eigenvalue of 2.07; no other factors were significant.⁴ Factor scores from this analysis were then used as a measure of management networking (what we call M_2), with higher scores indicating a greater network orientation.

Clearly, this measure is simplified and ignores all aspects of networking aside from frequency of contact, such as skill, reputation, and a number of strategic considerations. All five sets of actors are treated equally (in practice they would not be), and we do not measure how effective the superintendent is at building and using these networks. Still, the measure taps the effort that managers choose to put into managing externally in the network, and thus has some face validity. The factor-analytic results with uniformly positive loadings support the notion that network management as a strategic choice is a coherent concept that makes empirical sense.

Another way to validate the measure of network management is to see whether it correlates with other variables where relationships should exist. Superintendents who are more aggressive at network management, all other things being equal, should have a school district that has greater community support, greater school board support, and more parental involvement. Simply stated, more aggressive network management should result in greater support in the external environment. Our survey asked superintendents to rate community and school board support on a five-point scale from excellent to inadequate. The survey also asked for a similar evaluation of parental involvement.

Table 1 presents three regressions showing the relationship between network management and support from the school board, the community, and parents. To make sure that any relationships are not the result of better past performance, district poverty, or district resources (teacher salaries and revenues per student), we control for these factors. More network management is positively associated with support from the school board, support in the general community, and the level of parental involvement. Each relationship contributes additional evidence that we have created a reliable and valid measure of network management.

Table 1 Network Management Improves Environmental Support

Independent variables	Dependent variables		
	School board support	Community support	Parental involvement
Network management	.0691 (3.94)	.1126 (7.09)	.0764 (4.39)
Past performance	.0034 (1.94)	.0073 (4.67)	.0059 (3.40)
Low-income students	-.0033 (2.94)	-.0079 (7.64)	-.0122 (10.81)
Teacher salaries (k)	.0016* (0.24)	.0193 (3.13)	.0208 (3.08)
Revenue per student (k)	.0239 (1.85)	-.0204 (1.74)	.0042* (0.33)
R ²	.02	.09	.10
F	9.37	50.61	55.57
Standard error	.88	.80	.87
N	2,524	2,534	2,529

t-scores in parentheses
 * Not significant at the .05 level, one-tailed test.

Dependent Variable

Our measure of program outcome (O) represents the percentage of students in each school district who pass state-required, standardized reading, writing, and mathematics tests each year. While tests such as these clearly do not measure the entire student learning experience, they do tap into whether students are picking up basic academic skills from grade to grade. Because the exams themselves are highly salient and result in front-page news when released, the scores should be a relatively good performance measure for assessing management activities. Because our model relies heavily on the notion that bureaucracies are autoregressive institutions, student performance on these exams in the previous year is included in all models as an independent variable.

Environmental Variables

Environments, including networked environments, provide both opportunities and constraints (the X variables). Although program environments in general and those of school districts in particular are complex, we

simplify our analysis by focusing on only two sets of environmental variables—one cluster for the task difficulty (or constraints) facing the unit, and another for program resources (or opportunities). Task difficulty reflects the truism that some students are easier to educate than others. The literature consistently finds that poverty and race are correlated with greater education problems (Jencks and Phillips 1998). Poverty and race are associated both with fewer educational resources in the home and with other factors (for instance, single-family households) that may affect student learning. Our three specific measures of environmental constraints are the percentages of black, Latino, and poor students (the last measured as the percentage of students eligible for free school-lunch programs). Each variable should be negatively related to student performance.

Although the relationship between resources and student performance is controversial in education policy (Hedges and Greenwald 1996; Hanushek 1996), students of organization assume a direct link between resources and performance (Simon 1947; Thompson 1967). Recent education research using well-crafted research designs shows that additional resources are associated with higher student performance (Evans, Murray, and Schwab 1997; Wenglinsky 1997). Five measures of resources are included—average teacher salary, average class size, average years of teacher experience, percentage of noncertified teachers, and percentage of funds from state government. Teacher salaries and teacher experience should be positively related to student performance; class size and teacher noncertification should be negatively related to performance (small classes are a resource, large classes a constraint). State funds are included because the state provides a large portion of district resources, especially in low-income districts.

School districts, like many other public organizations, have only partial control over their inputs. Public schools have to educate everyone who shows up and adjust their technical processes to differing student needs. Similarly, the school district raises only a portion of its resources through its own taxing powers (and even those are limited by public support). It must convince other governments and other actors to provide the money needed to hire staff, build facilities, and educate students. Students and resources, therefore, are considered a part of the school system's environment (the X variables in our models).

Because our data are pooled (five years), we included a set of dummy variables for individual years to deal with the time-series aspect of the data set. These dummy variables were always jointly significant, reflecting positive trends in student performance. To deal with the other source of problems related to pools, we assessed the cross-sections of each equation for heteroscedasticity. The levels of

heteroscedasticity were modest and had little impact on the findings presented here.

Testing the Model

The basic reduced model for testing is reproduced below:

$$O_t = \beta_1 O_{t-1} + \beta_2 (X_t M_t) + \varepsilon_t \quad [3]$$

Before proceeding to test model [3], a nonlinear interactive model, we will first demonstrate that management matters in a simpler rendition: [4] a linear additive model,

$$O_t = \beta_1 O_{t-1} + \beta_2 X_t + \beta_3 M_t + \varepsilon_t \quad [4]$$

The results are presented in table 2. The key coefficient, network management, is positive and significant, indicating that network management matters in implementing education programs. Network management is by no means the most important variable in the model, but it does contribute positively to higher performance in this linear specification. Management matters, even if one ignores internal-management efforts to shape operations. More interestingly, the impact of network management from the superintendent's office shows that networking that is somewhat removed from individual schools and the usual tasks of education nonetheless shows up in concrete implementation results. Including an autoregressive term means that network management matters for results even beyond the heavy impact of the status quo (and several other variables), a provocative finding.

Some other findings in table 2 merit discussion because they will be incorporated into additional tests later on. First, the autoregressive component is the single most important explanatory factor in the model. The parameter estimate (0.7162) indicates a fair amount of inertia in delivering educational services, but the distance of that coefficient from 1.0 indicates the past does not rigidly determine current performance. Second, two key indicators of resources—teacher salaries and class size—are appropriately signed and significant. Because educational systems are personnel intensive, most resources in a school system go to either teacher salaries or to reductions in class size. Experience and noncertified teachers are both negatively related to performance, as expected. Similarly, the constraint variables are appropriately signed, although the variable for low-income students is not statistically significant.⁵

This linear-model estimate is interesting and promising, but it needs to be supplemented by a consideration of nonlinear elements (see equation [3] above). Nonlinear impacts can be assessed by using interaction terms or by examining relationships with different subsets of the sample. The former, although elegant, is often plagued by severe collinearity problems that prevent interpretation of

Table 2 The Impact of Network Management on District Performance

Dependent variable = test score pass rate	
Independent variable	Slope
Past performance	.7162 (63.98)
Network management	.1719 (1.65)
Resources	
Teacher salary (k)	.3704 (6.80)
Class size	-.0750 (1.69)
Experience	-.1526 (2.50)
Noncertified	-.0947 (3.95)
State aid	.0064* (1.21)
Constraints	
Black students	-.0593 (5.25)
Latino students	-.0413 (5.79)
Low-income students	-.0165* (1.62)
R ²	.81
Standard error	5.18
F	1,069.46
N	2,534
Mean dependent variable	73.9
<i>t</i> -scores in parentheses	
* Not significant at the .05 level, one-tailed test.	

coefficients. We will look for nonlinear relationships between management and program performance through physical controls, that is, by partitioning the data set.

Table 3 divides the districts into five quintiles by level of performance. The top quintile, for example, has a mean student pass rate of 79.2 compared to 73.9 for all districts and 64.8 in the lowest quintile. Care must be exercised in partitioning the sample, particularly when partitioning on the dependent variable, because each subset is designed to be unrepresentative of the entire sample. The prediction levels in table 3 increase dramatically compared to those in table 2; in the middle three quintiles, less than 1 percent of the variance is left unexplained.⁶

Quite clearly, we may have some intuition as to why network management matters more or less as organizations perform better. The regressions in table 3 show that network management's impact on performance is relatively stable in the middle three quintiles; these estimates are also statistically more reliable than those in table 2. For both the highest-performing and lowest-performing organizations, the management coefficient is much larger.⁷ Why might this be the case?

In a smoothly running organization that is attaining adequate performance, the demand for creative management

Table 3 Network Management at Different Levels of Educational Performance

Independent variable	Quintiles of performance 5 = Best				
	5	4	3	2	1
Past performance	.6645 (50.70)	.7189 (187.09)	.7150 (201.04)	.7201 (174.85)	.7330 (42.78)
Network management	.2792 (2.05)	.1579 (4.70)	.1626 (5.99)	.1766 (5.26)	.3727 (2.18)
Resources					
Teacher salary (k)	.2896 (4.15)	.3502 (18.38)	.3677 (23.90)	.3584 (19.26)	.5611 (6.90)
Class size	-.2646 (6.31)	-.0978 (6.38)	-.0946 (6.46)	-.0487 (2.67)	.2246 (2.88)
Experience	-.2619 (3.44)	-.1340 (6.32)	-.1342 (8.13)	-.1663 (7.60)	-.0766* (0.83)
Noncertified	-.1073 (4.23)	-.1044 (12.29)	-.1028 (15.43)	-.1085 (10.64)	-.0544* (1.53)
State aid	-.0304 (4.84)	.0095 (5.39)	.0073 (4.54)	.0040 (2.15)	.0291 (3.45)
Constraints					
Black students	-.1109 (7.69)	-.0548 (14.27)	-.0616 (18.81)	-.0573 (16.43)	-.0123* (0.68)
Latino students	-.0839 (9.83)	-.0402 (16.68)	-.0397 (17.54)	-.0404 (15.91)	-.0146* (1.42)
Low-income students	.0637 (4.97)	-.0138 (3.85)	-.0194 (6.19)	-.0146 (4.03)	-.0600 (4.11)
R ²	.91	.99	.99	.99	.92
Standard error	2.93	.75	.60	.76	3.71
F	485.13	9,253.65	13,210.42	10,394.95	485.13
N	518	531	484	522	519
Mean dependent variable	79.2	77.5	75.8	71.5	64.8
t-scores in parentheses					
* Not significant at the .05 level, one tailed test.					

and the opportunities to use that management may be relatively few. An organization that is interested in optimizing rather than satisficing (or one seeking to change its level of performance dramatically) is more likely to seek opportunities to exploit inside the organization or in its environment. An aggressive superintendent in this regard might seek a larger bond issue for capital expansion, try new programs for parental involvement, or use traditional resources in nontraditional ways. Seeking higher levels of performance relative to environmental constraints (as these models are set up) requires taking more risk, and management efforts (networking) and skills should come more into play.

For those units at the low end of the performance scale, the function of network management is somewhat different, but equally important. These organizations are performing poorly, and that performance is likely recognized by both the district and environmental actors. In a poorly running unit, almost any improvement will get some returns. Good external management in such a situation is likely to matter more because it compensates for inadequate processes and decisions in other parts of the core organization. Such leadership also may have a salutary impact on internal morale as members see actions being taken to improve the organization.

The autoregressive coefficient representing past performance also merits comment. As organizational performance increases, the size of the autoregressive parameter decreases; the parameter in the top quintile is statistically smaller than the estimate for all organizations. This finding suggests that high-performing organizations are less constrained by past performance than organizations with weaker performance. Because a network-style management interacts with the environment (O'Toole and Meier 1999), this pattern is consistent with tapping opportunities externally and, in the process, reducing organizational rigidity.

This relationship reveals a paradox of organizational management. At the highest levels of performance, stability is a good thing. As performance in an organization declines, stability has less value simply because the organization is reproducing poor performance. The results of table 3 suggest that stability is greater exactly where stability is least valuable to the organization.⁸

Other relationships in table 3 also change as organizational performance improves. In particular, resources appear to vary in their relationship to performance. This variance suggests that we should consider how network

management interacts with resources, given that a primary function of management is to allocate resources to achieve goals. Our nonlinear model of management suggests that different levels of management skill are likely to exploit resources for different effects, so exploring this relationship may provide clues to how networking managers leverage opportunities in their interdependent, complex settings.

To determine how management interacts with resources, we ran a series of regressions that successively varied the value for network management and examined what happened with the other variables. Comparing these regressions to the overall regression with all cases should tell us a great deal about how management in the network conditions the use of resources.

Table 4 presents the results for districts run by superintendents who rated highly on the network management variable. Because we are interested in probing what happens when managers undertake frequent and extensive networking, we focus on the high-networking cases here. Subsets of the sample that include larger networking values can be compared with the full set of cases (column 1). The first subset (column 2 in the table) includes only superintendents with management scores above 1 (or one standard deviation above average)—about 18 percent of

all managers. Subsequent regressions, listed in successive columns of the table, raise this standard by 0.25 standard deviation in a series of steps until only the top 4 percent remain (those scoring above 2.0). This incremental process of examination illustrates how the relationships evolve at different levels of network-management activity. Because we are selecting less and less representative organizations, our interpretation should be cautious and avoid assessing patterns where the relationships are not strong. We will generally limit our discussion, therefore, to teacher salaries, class size, and the autoregressive term.

As network management increases, the autoregressive term declines slowly until the management variable is 1.5 standard deviations above the mean, and then precipitously. This pattern suggests that network management performs its desired function; rather than being trapped by past routines and behaviors, well-networked organizations have more flexibility to change. This should be viewed as the first part in a two-step process of managing the organization: first, exploiting the environment to create change in the unit, and second, structuring the changes to produce higher performance.⁹ Changing the size of the autoregressive component in the model dramatically changes the long-run impact of other variables because current values

of the independent variables continue to affect future performance by feeding back through the autoregressive term (O'Toole and Meier 1999). The finding suggests that the influence of network management ramifies into the future and may substantially enhance performance in the long term.

The impact of teacher salaries on student performance shows a clear pattern of interaction with network management. As network management increases, the impact of higher salaries increases dramatically. At management levels two standard deviations above the mean, the slope for teacher salaries is 3.27 times larger than its impact for all districts.

Why might teacher salaries interact so strongly with network management? First, higher salaries permit superintendents to compete in the current tight labor market for the exact type of teacher needed to implement the district's curriculum.¹⁰ Second, higher salaries reduce turnover (Eller, Meier, and Doerfler 2000).¹¹ Lower turnover has three benefits: Resources are committed to teaching rather than recruiting; the district's teachers are more familiar with curricular and other district policies; and at the margins, higher salaries can affect morale. Although we do not know the precise reason why teacher salaries matter so much in better network-managed organizations, we have identified strong nonlinear relationships among management, resources, and performance and outlined reasons why this might occur.

Class size also shows a similar (albeit more varied) pattern. The impact of class size increases dramatically at higher levels of network management; at 1.5 standard deviations above the average network management, the impact of smaller classes is 8.6 times larger than it is for all school districts. The reliability of these estimates, however, drops rapidly at high levels, suggesting that although there are some interaction effects between management and class size, they are not as consistent and predictable as those for the other resource variable, teacher salaries. We can be fairly confident that good network management makes more effective use of smaller classes, but how much it matters needs additional research.¹²

Although our assessment of the interactions among management and other factors was limited to only three variables, other interesting patterns also exist. For example, the coefficient for low-income students changes from negative and insignificant to positive and significant. Whether this is a meaningful change cannot be determined with the cur-

Table 4 Network Management Interactions with Resources and Constraints

Independent variable	All	Level of management				
		1.0	1.25	1.5	1.75	2.0
Past performance	.7172 (63.65)	.6726 (24.08)	.6431 (17.00)	.6302 (13.92)	.5942 (11.34)	.4732 (5.65)
Resources						
Teacher salary (k)	.3679 (6.75)	.5539 (4.08)	.6983 (4.12)	.7351 (3.61)	.8554 (3.77)	1.2034 (3.38)
Class size	-.0752 (1.69)	-.4625 (3.17)	-.5713 (3.15)	-.6477 (2.99)	-.4970 (2.09)	-.2353* (0.63)
Experience	-.1448 (2.38)	-.1274* (0.84)	-.1526* (0.77)	-.0904* (0.37)	-.3115* (1.15)	-.8530 (1.69)
Noncertified	-.0947 (3.95)	-.1317 (2.38)	-.1674 (2.30)	-.1416 (1.77)	-.2837 (2.62)	-.2673* (1.43)
State aid	.0074* (1.39)	.0079* (0.54)	.0003* (0.02)	.0059* (0.27)	.0337* (1.21)	.0013* (0.03)
Constraints						
Black students	-.0586 (5.19)	-.0179* (0.57)	-.0283* (0.71)	-.0301* (0.68)	-.0533 (1.14)	-.2449 (2.51)
Latino students	-.0412 (5.76)	-.0325 (1.66)	-.0593 (2.44)	-.0706 (2.32)	-.0785 (2.12)	-.1736 (2.25)
Low-income students	-.0165* (1.62)	-.0646 (2.29)	-.0391* (1.03)	-.0406* (0.94)	-.0074* (0.16)	.1529 (1.86)
R ²	.81	.80	.84	.82	.80	.77
Standard error	5.18	5.17	4.37	4.51	4.45	4.54
F	1187.17	199.09	148.33	101.87	70.94	31.82
N	2,534	450	260	205	165	95
Mean dependent variable	73.9	74.6	75.5	76.6	76.4	77.3
Mean network management	0.0	1.59	1.91	2.04	2.14	2.35
<i>t</i> -scores in parentheses						
*Not significant at the .05 level, one-tailed test.						

rent data and is likely to be verifiable only through in-depth case studies.

Even leaving aside these additional, potentially interesting relationships, there is good reason to consider the results discussed here as substantial evidence supporting the notion that network management can play a meaningful role in implementation success. Management is about choice and decision making. Quite clearly, networking managers decide to allocate more time and effort to some constraints and resources than to others. Expecting networkers to leverage uncritically all resources and to buffer all constraints may conflict with what the manager is actually trying to do. A manager is likely to focus on a select number of factors that can be influenced to get better results. The relationships in table 4 are consistent with such an interpretation.

Implications for Research and Practice

Public managers inhabit a networked world, and many analyses have documented that these managers devote part of their energy and talents to dealing with their complicated, interdependent environment. What has not been clear until now is whether such activities matter in the implementation performance of programs. While consensus has long held that public managers must attend to the external world (Long 1949), most would argue that such efforts pay off primarily in terms of agency aggrandizement or public relations rather than in policy results. This article, however, supports the claim that, in at least one significant public policy sector, network management can contribute to program performance.

This study shows the important, direct impact of these efforts on policy outcomes. The findings are especially intriguing because the test for network-managerial impact is strong and because the autoregressive function suggests even greater impact than is obvious at first glance.

The findings are strong for several reasons: The measure of network management is simplified, but it is clearly framed to tap only managerial efforts outside the core education organization, and only from district headquarters. The measure is not contaminated by the management of educational operations directly. The findings consistently show network-managerial impact on the most salient performance measure in Texas, whether in linear or nonlinear specifications. The nonlinear impacts are consistent with theoretical arguments about how networking managers can influence results. These results are especially interesting considering the autoregressive form of the model makes it difficult to show significant results because the lagged dependent variable itself explains so much of the variance in performance.

The autoregressive form also indicates that an investment in network management now can pay dividends in the future. Networking outward with multiple actors and with frequency strengthens program performance in the short run and builds a baseline for future enhancements. While our findings are from one program field in one state, managers elsewhere may want to seriously consider how they apportion their own efforts when operating in an interdependent setting.

Furthermore, the results of this analysis suggest that network management matters even more in high-performing and low-performing cases. Better-functioning units are less limited by established performance and can find ways of catalyzing even more results. How? At least part of the explanation seems related to the way that managers operating in their networked environment create room for maneuvering. More networking in more directions means less limited, incremental changes in performance from one time period to the next. And networking managers are able to take greater advantage of selected resources.

In short, in this situation, network management contributes to implementation success and concrete program results, which in turn build results for later. Network management helps to free educational units from the constraints of existing routines and allows them to use selected available resources more effectively.

The evidence here indicates that public managers need to consider network management as an important tool for administrative success, not merely a luxury to engage in if there is extra time. Networkers in our sample spent less time running internal operations than did others (see note 4), but the trade-off paid in results.

While provocative, these findings are only one step on the road to understanding networking public management for implementation success. Future studies of network management should focus on developing better measures of network management. The quality of the interactions, the content of the interactions, the decision-making skills of the manager, and the complexity of the network itself also need to be measured. Additional studies should assess other program fields, consider a range of performance indicators, probe the nonlinear impacts sketched here in depth, and systematically explore the specific kinds of strategic choices that contribute to success when networkers engage their environment. There are plenty of reasons to investigate these questions with care. As networked settings proliferate and managers find themselves more intricately bound with interdependent partners, these issues are likely to become more pressing, and the results of increasing importance in the world of practice.

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Notes

1. Districts responding to the survey, conducted during 2000, were no different from nonrespondents in enrollment, enrollment growth, students' race, ethnicity, and poverty, or test scores. There were slight differences in a few other factors. Respondents had 0.48 more students per class, paid their teachers \$200 more per year, but had annual operating budgets of about \$100 less per student.
2. "Independent" has a specific meaning in regard to school districts. It means the district selects its own governing board (as opposed to having another jurisdiction appoint the board), and it possesses independent taxing power.
3. We replicated this analysis, omitting school boards from the measure. The results of that analysis were similar to those presented here; the two measures correlate at 0.96.
4. The network-management-style factor correlates at -0.27 with time spent managing the district (in contrast to time spent on contacts outside the organization).
5. Relatively important variables such as this one can be insignificant in an autoregressive model because they change slowly and past levels of the variables are already incorporated into the model through the lagged dependent variable.
6. Only the within-quintile variance is explained in these analyses. The middle quintiles eliminate a great deal of the cross-district variance.
7. As one would expect, the standard errors increase at the extremes, suggesting some caution in interpreting the results. We view these findings as suggestive until confirmed by other empirical studies.
8. This finding has implications for management theory and how to manage organizations, that is, the degree of hierarchical structure that managers should create (Drucker 1967).
9. Management in this situation is both a decision to act and then a match of the strategy with the situation (Lynn 1984). The decision to act in no way guarantees the strategy selected will pay off.

10. Interviews reveal that good superintendents have clear goals and seek to hire staff and teachers who share those goals. This matching is facilitated if the superintendent can offer a competitive or better salary. Similarly, in fields with severe shortages, such as mathematics and science, a higher salary may be the difference between attracting a certified teacher and having to make do with an uncertified one. Coupled with positive leadership, better-qualified teaching professionals are bound to contribute to higher performance.
11. Turnover in school districts is fairly high, approximately 14.6 percent annually. Managing this turnover is a major challenge for school superintendents. The models in Eller, Meier, and Doerfler (2000) control for teacher experience, so this relationship does not result from the higher salaries of more experienced teachers.
12. One possibility is that networking to generate greater environmental support can aid the superintendent in avoiding disputes about why school X receives more resources than school Y. Superintendents need to allocate more resources to areas with greater problems, and this intradistrict inequity is often controversial.

References

- Agranoff, Robert, and Michael McGuire. 2000. *Managing across Governments and Organizations*. Unpublished book manuscript.
- Bogason, Peter, and Theo A.J. Toonen, eds. 1998. Comparing Networks. Symposium in *Public Administration* 76(2): 205–407.
- Bressers, Hans, Laurence J. O'Toole, Jr., and Jeremy Richardson, eds. 1995. *Networks for Water Policy: A Comparative Perspective*. London: Frank Cass.
- Chubb, John, and Terry M. Moe. 1990. *Politics, Markets and America's Schools*. Washington, DC: Brookings Institution.
- Drucker, Peter. 1967. *The Effective Executive*. New York: Harper and Row.
- Eller, Warren S., Kenneth J. Meier, and Carl Doerfler. 2000. Changing Dimes to Dollars: An Empirical Look at Maslow's and Herzberg's Motivation Theories. Paper presented at the annual meeting of the American Political Science Association, August 31–September 3, Washington, DC.
- Evans, William N., Shelia E. Murray, and Robert M. Schwab. 1997. Schoolhouses, Courthouses, and Statehouses After Serrano. *Journal of Policy Analysis and Management* 16(1): 10–31.
- Friend, J.K., J.M. Power, and C.J.L. Yewlett. 1974. *Public Planning: The Inter-Corporate Dimension*. London: Tavistock.
- Gage, Robert W., and Myrna P. Mandell, eds. 1990. *Strategies for Managing Intergovernmental Policies and Networks*. New York: Praeger.
- Gross, Neal, Ward S. Mason, and Alexander W. McEachern. 1958. *Explorations in Role Analysis: Studies of the School Superintendency Role*. New York: Wiley.

- Hall, Thad E., and Laurence J. O'Toole, Jr. 2000. Structures for Policy Implementation: An Analysis of National Legislation, 1965–1966 and 1993–1994. *Administration and Society* 31(6): 667–86.
- Hanushek, Erik. 1996. School Resources and Student Performance. In *Does Money Matter?* edited by Gary Burtless, 43–73. Washington, DC: Brookings Institution.
- Hedges, Larry V., and Rob Greenwald. 1996. Have Times Changed? The Relation between School Resources and Student Performance. In *Does Money Matter?* edited by Gary Burtless, 74–92. Washington, DC: Brookings Institution.
- Hjern, Benny, and David O. Porter. 1981. Implementation Structures: A New Unit of Administrative Analysis. *Organization Studies* 2(3): 211–37.
- Hufen, Hans, and Arthur Ringeling, eds. 1990. *Beleidsnetwerken: Overheids-, Semi-overheids-, en Particuliere Organisaties in Wisselwerking* (Policy networks: public, semi-public, and private organizations in interaction). The Hague: VUGA.
- Jencks, Christopher, and Meredith Phillips, eds. 1998. *The Black-White Test Score Gap*. Washington, DC: Brookings Institution.
- Jordan, Grant, and K. Schubert. 1992. A Preliminary Ordering of Policy Network Labels. *European Journal of Political Research* 21(1/2): 7–27.
- Kickert, Walter J.M., Erik-Hans Klijn, and J.F.M. Koppenjan, eds. 1997. *Managing Complex Networks: Strategies for the Public Sector*. London: Sage Publications.
- Klijn, Erik-Hans. 1996. *Regels en Sturing in Netwerken* (Rules and steering in networks). Delft: Eburon.
- Long, Norton E. 1949. Power and Administration. *Public Administration Review* 9(4): 257–64.
- Lynn, Laurence E., Jr. 1984. The Reagan Administration and the Renitent Bureaucracy. In *The Reagan Presidency and the Governing of America*, edited by Lester M. Salamon, 339–70. Washington, DC: Urban Institute.
- Mandell, Myrna. 1984. Application of Network Analysis to the Implementation of a Complex Project. *Human Relations* 37(8): 659–79.
- Marin, B., and Renate Mayntz, eds. 1991. *Policy Networks: Empirical Evidence and Theoretical Considerations*. Boulder, CO: Westview Press.
- Marsh, David, and R.A.W. Rhodes, eds. 1992. *Policy Networks in British Government*. Oxford: Clarendon Press.
- Meier, Kenneth J., and Joseph Stewart. 1991. *The Politics of Hispanic Education*. Albany, NY: State University of New York Press.
- Milward, H. Brinton, and Keith G. Provan. 2000. Governing the Hollow State. *Journal of Public Administration Research and Theory* 10(2): 359–79.
- Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions of Collective Action*. Cambridge, UK: Cambridge University Press.
- O'Toole, Laurence J., Jr. 1983. Inter-Organizational Cooperation and the Implementation of Active Labour Market Training Policies: Sweden and the Federal Republic of Germany. *Organization Studies* 4(2): 129–50.
- . 1997. Treating Networks Seriously: Practical and Research-Based Agendas in Public Administration. *Public Administration Review* 57(1): 45–52.
- . 1998. *Institutions, Policy and Outputs for Acidification: The Case of Hungary*. Aldershot, UK: Ashgate.
- . 2000. Different Public Managements? Implications of Structural Context in Hierarchies and Networks. In *Advancing Public Management*, edited by Jeffrey Brudney, Laurence J. O'Toole, Jr., and Hal G. Rainey, 19–32. Washington, DC: Georgetown University Press.
- O'Toole, Laurence J., Jr., and Kenneth J. Meier. 1999. Modeling the Impact of Public Management: Implications of Structural Context. *Journal of Public Management Research and Theory* 9(4): 505–26.
- Peterson, John, and Laurence J. O'Toole, Jr. 2001. Federal Governance in the U.S. and the EU: A Policy Network Perspective. In *The Federal Vision: Legitimacy and Levels of Governance in the U.S. and the EU*, edited by Kalypso Nicolaidis and Robert Howse, 300–34. Oxford, UK: Oxford University Press.
- Pressman, Jeffrey, and Aaron Wildavsky. 1984. *Implementation*. 3rd ed. Berkeley, CA: University of California Press.
- Provan, Keith G., and H. Brinton Milward. 1995. A Preliminary Theory of Network Effectiveness: A Comparative Study of Four Mental Health Systems. *Administrative Science Quarterly* 40(1): 1–33.
- Scharpf, Fritz W., ed. 1993. *Games in Hierarchies and Networks: Analytical and Empirical Approaches to the Study of Governmental Institutions*. Boulder, CO: Westview Press.
- Simon, Herbert A. 1947. *Administrative Behavior*. New York: Free Press.
- Stoker, Robert P. 1990. *Reluctant Partners: Implementing Federal Policy*. Pittsburgh, PA: University of Pittsburgh Press.
- Thompson, James D. 1967. *Organizations in Action*. New York: McGraw-Hill.
- Tyack, David B. 1974. *The One Best System: A History of American Urban Education*. Cambridge, MA: Harvard University Press.
- Wenglinsky, Harold. 1997. *How Educational Expenditures Improve Student Performance and How They Don't*. Princeton, NJ: Educational Testing Service.
- Zeigler, Harmon, Ellen Kehoe, and Jane Reisman. 1985. *City Managers and School Superintendents: Response to Community Conflict*. New York: Praeger.